M27 Junction 4 To 11

Noise technical note

Pavement assumptions

PCF Stage No 5 & 6

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1. Introduction

1.1.1. The original Environmental Assessment Report (EAR) produced for the M27 Junctions 4 to 11 Smart Motorway (SM) project, hereafter referred to as the "proposed scheme", assumed that during the construction of the proposed scheme, the existing hard shoulder and running lanes between Junctions 5 and 7 would be resurfaced with a new Low Noise Road Surface (LNRS), replacing the existing concrete surface. Consequently, in the year of scheme opening, all running lanes would be new LNRS between Junctions 5 and 7.

1.1.2. Since the production of the EAR, Highways England has undertaken additional investigation of the concrete pavement and now understands that the previous assumption that, due to potential voids under the concrete pavement, it would require treatment with an overlay was incorrect. The testing and investigations have demonstrated that the existing concrete is structurally sound and suitable for upgrade to a SM. As a consequence of not needing to treat the concrete, there is no need to resurface and the existing concrete surface between Junctions 5 and 7 will be retained. This noise addendum has therefore been undertaken to ensure the conclusion reached within the EAR are still valid.

1.1.3. For the purposes of this report, the SM lane naming convention will be used throughout. Table 1.1 below provides an illustration of how the existing lane naming convention (for a typical 3 lane motorway) is transposed into the SM lane naming convention.

Table 1.1 : Lane naming convention

Existing	Hard Shoulder	Lane 1	Lane 2	Lane 3
Smart Motorway	Lane 1	Lane 2	Lane 3	Lane 4

1.1.4. This Technical Note has been prepared to detail the findings of the reassessment of noise impacts as a result of switching from the EAR assumption that new LNRS would be provided on all lanes in opening year, to retaining the concrete surface on all lanes between Junctions 5 and 7.

1.1.5. It should be noted that this assessment assumes that all proposed noise barriers detailed in the EAR are retained and that the pavement assumptions on the remainder of the proposed scheme (i.e. between Junctions 4 and 5, and 7 to 11) are as reported in the EAR[1], so that a like-for-like comparison can be made between this assessment and the EAR. All other design assumptions within the EAR remain valid, including construction phase assumptions, and there is

[1] The pavement assumptions on the remainder of the proposed scheme (i.e. between Junctions 4 and 5, and 7 to 11) were that Lanes 1 and 4 would be resurfaced with a new LNRS in the 2021 opening year and all four lanes would be resurfaced with a new LNRS by 2036.

therefore no effect on the assessment presented within the EAR due to any changes to other design assumptions.

1.1.6. The results in this Technical Note are for the M27 Junctions 4 to 11 SM scheme only. Given that the traffic data for the cumulative scenario (M27 Junctions 4 to 11 SM scheme and M3 Junctions 9 to 14 SM scheme) were very similar, the conclusions of this Technical Note are considered valid for the cumulative assessment as well.

1.1.7. Further to the above, it should be noted that the assessment methodology remains as presented in the EAR, and it is considered that the potential change in the pavement strategy does not affect the results and conclusion of the construction noise and vibration assessment. It is recommended that this memorandum be read in conjunction with Section 8 of the EAR.

2. Background

2.1.1. The current pavement on the M27 between Junctions 5 and 7 consists of a concrete surface.

2.1.2. An EAR was produced in advance of SGAR 3 for the proposed scheme. This EAR was produced assuming that as part of the proposed scheme construction works, all three lanes of the M27 main carriageway and the existing hard shoulder between Junctions 5 and 7 would be resurfaced with a new LNRS.

2.1.3. Since the production of the EAR, Highways England has undertaken additional investigation of the concrete pavement and now understands that the previous assumption that, due to potential voids under the concrete pavement, it would require treatment with an overlay was incorrect and that the existing concrete is structurally sound and suitable for upgrade to a SM. As a consequence of not needing to treat the concrete, there is no need to resurface and the existing concrete surface between Junctions 5 and 7 will be retained.

2.1.4. The purpose of this assessment is to determine whether this change in resurfacing strategy would:

- Result in any significant adverse impacts at noise sensitive receptors (NSRs), see paragraph 2.1.5 below for further detail;
- Result in additional noise mitigation being required for the proposed scheme to mitigate significant adverse effects;
- Affect the results and outcomes of the cost benefit analysis of the noise barriers as presented in the EAR, thus resulting in additional/reduced noise mitigation and enhancement measures;
- Still result in the proposed scheme meeting the aims of the Noise Policy Statement for England (NPSE)[2] and the Planning Practice Guidance (PPG)[3]; and
- Affect the conclusions of the EAR.

2.1.5. The Design Manual for Roads and Bridges (DMRB) HD 213/11 states in paragraph 3.37 that "in terms of permanent impacts, a change of 1 dB(A) in the short-term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long-term, a 3 dB(A) change is considered perceptible. Such increases in noise should be mitigated if possible". Therefore, for the purposes of this assessment, the following road traffic noise change thresholds (aligned with a minor magnitude of impact in the DMRB HD 213/11) have been used to

[2] Defra (2010). Noise Policy Statement for England (NPSE).
[3] Department for Communities and Local Government (2016), *Planning practice guidance*

indicate the potential for a significant effect to arise in the context of the EIA Regulations:

- ≥ ±1 dB $L_{A10,18h}$ in the Do Minimum opening year 2021 to Do Something opening year 2021 scenarios (short-term), where the receptor already exceeds the Lowest Observable Adverse Effects Level (LOAEL) threshold;
- ≥ ±3 dB $L_{A10, 18h}$ in the Do Minimum opening year 2021 to Do Something / Do Minimum design year 2036 scenarios (long-term), where the receptor already exceeds the LOAEL threshold.

3. Assumptions and methodology

3.1. Methodology

3.1.1. The guidance contained within the DMRB HD 213/11 for situations of mixed surfaces is tailored mainly to 3 lane carriageways, and suggests taking the correction associated with the dominant surface type. This approach however may not be appropriate for use for a carriageway of 4 lanes, where two lanes are one material and two lanes are another material (for example a Smart Motorway Project where only lanes 1 and 4 are resurfaced) as there is no dominant surface type present. It is therefore considered that a more accurate approximation is required.

3.1.2. Contained within the *Road surface correction for use with CRTN paper* (M Muirhead, presented at the Proceedings of the Institute of Acoustics, Vol. 40 Pt. 1. 2018) is a formula which takes account of the number of lanes across the carriageway and the Road Surface Influence (RSI) value for each of these lanes. This approach uses an estimated RSI for each individual lane to estimate an overall RSI for the carriageway as a whole. The formula, shown below, is considered robust since it will take account of changes to any single lane.

$$RSI = 10log_{10}\left\{\frac{\sum_{i=1}^{nl} 10^{\frac{Ni+RSI_i}{10}}}{\sum_{i=1}^{nl} 10^{Ni/10}}\right\}$$

Where nl is the number of lanes, RSIi is the RSI in the i^{th} lane (the nearside running lane of the carriageway being i = 1) and Ni = -2i.

3.1.3. The formula above logarithmically averages the RSI but slightly weights the overall RSI in a hierarchical fashion such that the greatest weight is given to lane 1 and the least weight to lane 4.

3.1.4. It is acknowledged that the approach does not take into account many other factors which could impact the overall RSI, such as:

- The relative traffic flows on each running lane;
- The proportion of heavy goods vehicles (HGV%) in each lane;
- The speed of vehicles travelling in each lane;
- The age of the road surface; and,
- The difference in distance between the individual source terms (lanes) and the NSR(s).

3.1.5. The above bullets are all limitations of using this approach, however, this approach is still thought to be more suitable for assignment of RSI for mixed

surfaces than the guidance provided in DMRB HD 213/11 for road surface corrections.

3.1.6. Using the pavement figures provided in Appendix A and the above formula, it has been possible to calculate the overall surface correction for a carriageway based on the differing surfaces present in each lane of the carriageway between Junctions 5 and 7.

3.2. Road surface in opening year and Design year without the proposed scheme (DM 2021 and DM 2036)

3.2.1. As can be seen from the figures in Appendix A, the existing road surface on the M27 between Junctions 4 and 11 is a mixture of thin surfacing (LNRS) and hot rolled asphalt (HRA), with a concrete surface between Junctions 5 and 7.

3.2.2. In the Do Minimum design year scenario (DM 2036), it is assumed in both the EAR and in this Technical Note that all sections of HRA and existing LNRS on motorway links would be replaced with a new LNRS due to a lack of skidding resistance. However, the concrete section between Junctions 5 and 7 would not be resurfaced.

3.2.3. The DMRB HD 213/11 Annex 4 Paragraphs A4.18 to A4.33 provides information on surface corrections to use for noise modelling purposes for situations for a typical 3-lane motorway, such as the Do Minimum scenarios (DM 2021 and DM 2036). The road surface corrections that have been applied within the noise model are presented in Table 3.2.

3.2.4. For the concrete surface, the road surface correction has been taken from the 2014 draft of the update to the Calculation of Road Traffic Noise (CRTN) in the absence of further guidance in existing published best practice documents. A +3.5 dB correction has been applied for road links with a concrete surface, irrespective of speed.

3.3. Proposed road surface in opening year and Design Year (DS 2021 and DS 2036) – Concrete retained

3.3.1. As part of the proposed scheme construction works, it is assumed in both the EAR and in this Technical Note that between Junctions 4 and 5 and Junctions 7 to 11, lanes 1 and 4 would be resurfaced with a new LNRS and the existing LNRS on lanes 2 and 3 would remain. In addition, any areas of HRA would be resurfaced with a LNRS.

3.3.2. In the EAR, is was assumed that the concrete surface between Junctions 5 and 7 would be replaced with four lanes of new LNRS. The assessment presented in

this Technical Note assumes that the existing concrete surface between Junctions 5 and 7 will be retained.

3.3.3. These assumed changes in road surface for this updated assessment are shown in the table below.

Table 3.1 : Road surface changes

Road surface in each assessment scenario			
DM 2021	**DM 2036**	**DS 2021**	**DS 2036**
3 lanes existing LNRS	3 Lanes new LNRS	Lanes 1 and 4 new LNRS, lanes 2 and 3 existing LNRS	New LNRS
HRA	New LNRS	New LNRS	New LNRS
Concrete	Concrete	Concrete	Concrete

3.3.4. Using the formula presented in section 3.1 above, the road surface correction for lanes 1 and 4 with a new LNRS and lanes 2 and 3 with an existing LNRS is -3 dB.

Table 3.2 : Road surface correction

Road Surface type	Surface correction, dB		Source
	Speed >=75 kph	**Speed < 75 kph**	
Existing LNRS	-2,5	-1	DMRB HD 213/11
New LNRS	-3,5	-1	DMRB HD 213/11
HRA	-0.5	-1	DMRB HD 213/11
Concrete	+3,5	+3,5	Draft CRTN: 2014
Lanes 1 and 4 new LNRS, Lanes 2 and 3 existing LNRS	-3	-1	M Muirhead:2018 *Road surface correction for use with CRTN*

4. Results and analysis

4.1. DMRB HD 213/11 Assessment

Methodology

4.1.1. The proprietary software CadnaA has been used to predict noise levels at residential properties and other potentially sensitive receptor locations within the Calculation Area, as defined by the DMRB HD 213/11. For further details on the construction of the noise model itself, see Chapter 8 of the EAR.

4.1.2. The assessment of noise impacts has involved a comparison of the predicted noise levels resulting from the proposed scheme, with the concrete section between Junctions 5 and 7 retained, in line with the guidance presented in the DMRB HD 213/11:

- DS short-term change in noise level (DS 2021 vs DM 2021), as shown in the figure in Appendix B.
- DS long-term change in noise level (DS 2036 vs DM 2021), as shown in the figure in Appendix C.

Short-term noise level change

4.1.3. Table 4.1 provides the results of the DMRB HD 213/11 short-term assessment with the proposed scheme with the concrete section between Junctions 5 and 7 retained and mitigation/enhancement measures in place. This assessment has been carried out for a total of 14,922 residential receptors and 122 non-residential noise sensitive receptors, including schools, health, community and leisure facilities.

Table 4.1 : Short-term traffic noise changes with concrete surface between Junctions 5 and 7 retained and mitigation/enhancement measures in place (DMRB HD 213/11 Table A1.1)

Change in noise level		Magnitude of impact	Daytime	
			Number of dwellings	Number of other sensitive receptors
Increase in noise level, LA10,18h	0.1 - 0.9	Negligible	3,204	41
	1 - 2.9	Minor	8	0
	3 – 4.9	Moderate	0	0
	>=5	Major	0	0
No change	= 0	No change	2,388	11
Decrease in noise level, $L_{A10,18h}$	0.1 - 0.9	Negligible	9,191	70

Change in noise level		Magnitude of impact	Daytime	
			Number of dwellings	Number of other sensitive receptors
Decrease in noise level, $L_{A10,18h}$	0.1 - 0.9	Negligible	9,191	70
	1 - 2.9	Minor	112	0
	3 – 4.9	Moderate	10	0
	>=5	Major	9	0

4.1.4. Within the EAR, it was reported that eight dwellings near Swanwick were predicted to experience minor adverse impacts. Through further analysis, it was determined that these impacts were due to the way in which absorptive barriers were modelled (as reflective) rather than it being an effect of the proposed scheme. Consequently, the EAR concluded that no significant increases would occur at any NSRs as a result of the proposed scheme.

4.1.5. With the concrete surface between Junctions 5 and 7 retained, eight dwellings are still predicted to experience minor adverse impacts. These eight dwellings do not fall between Junctions 5 and 7. As noted above, this is due to the way in which absorptive barriers were modelled. Therefore, no significant noise increases are predicted as a result of proposed scheme, with the concrete surface retained.

4.1.6. In terms of perceptible benefits (i.e. minor to major), the EAR reported that a total of 4,302 NSRs were predicted to experience perceptible benefits with the proposed scheme and mitigation/enhancement measures in place. With the concrete surface between Junctions 5 and 7 retained, a total of 131 NSRs are predicted to experience significant benefits with the proposed scheme in place.

4.1.7. In summary, retaining the concrete surface between Junctions 5 and 7 does not result in any additional significant effects at NSRs; therefore no further mitigation measures are required. However, it should be noted that retaining the concrete surface results in the proposed scheme being less beneficial compared with resurfacing all four lanes with a new LNRS between Junctions 5 and 7, with 4,171 fewer NSRs experiencing perceptible benefits.

Long-term noise level Change

4.1.8. Table 4.2 provides the results of the HD 213/11 long-term assessment with the proposed scheme with the concrete section between Junctions 5 and 7 retained and mitigation/enhancement measures in place.

Table 4.2 : Long-term traffic noise changes with concrete surface between Junctions 5 and 7 retained and mitigation/enhancement measures in place (DMRB HD 213/11 Table A1.2)

Change in noise level		Magnitude of impact	Daytime		Night-time
			Number of dwellings	Number of other sensitive receptors	Number of dwellings
Increase in noise level, $L_{A10,18h}$	0.1 - 2.9	Negligible	10,337	97	2,882
	3 - 4.9	Minor	74	4	0
	5 – 9.9	Moderate	0	0	0
	>=10	Major	0	0	0
No change	= 0	No change	923	3	463
Decrease in noise level, $L_{A10,18h}$	0.1 - 2.9	Negligible	3,572	18	1,835
	3 - 4.9	Minor	15	0	57
	5 – 9.9	Moderate	1	0	5
	>=10	Major	0	0	0

4.1.9. Within the EAR, it was reported that 67 dwellings and four other sensitive receptors were predicted to experience minor adverse impacts. However, the majority of these impacts were due to development within the area rather than the proposed scheme, with the latter contributing less than 1 dB to the predicted noise increase. In other words, the majority of these impacts are predicted to occur whether or not the proposed scheme is constructed. Therefore, these effects were considered not to be significant in the context of the EIA Regulations for the proposed scheme.

4.1.10. With the concrete surface between Junctions 5 and 7 retained, 74 dwellings and four other sensitive receptors are predicted to experience minor adverse impacts, an increase of seven dwellings from the EAR. Upon further analysis, the increase in noise levels at the additional seven dwellings is also due to development within the area rather than the proposed scheme, with the latter contributing less than 1 dB to the predicted increase. Therefore, the conclusion presented in the EAR remains that the effects are considered not to be significant in the context of the EIA Regulations for the proposed scheme, with the concrete surface retained.

4.1.11. In terms of perceptible benefits, the EAR reported that a total of 2,062 NSRs were predicted to experience perceptible beneficial impacts with the proposed scheme and mitigation/enhancement measures in place. With the concrete surface retained, a total of 16 NSRs are predicted to experience significant beneficial impacts in the long term. Therefore, with the retention of the concrete

surface between Junctions 5 and 7 there would be 2,046 fewer NSRs experiencing perceptible benefits.

4.1.12. In summary, the retention of the concrete surface between Junctions 5 and 7 has changed some of the predicted impacts, but no additional significant adverse effects are generated.

4.2. Analysis of noise mitigation and enhancement measures

4.2.1. As part of the EAR, a detailed analysis of the provision of noise mitigation and enhancement measures was undertaken following the methodology to value noise described in the report *Environmental Noise: Valuing impact on: sleep disturbance, annoyance, hypertension, productivity and quiet* (Defra, November 2014). The described process has been used to monetise the noise benefits achieved as a result of the attenuation afforded by a noise barrier, with this monetised benefit being compared against the cost of installing and maintaining that barrier. Where the cost benefit ratio of a noise barrier, or the Value for Money (VFM) ratio, is 1.0 or greater, this is considered a good indication that the barrier offers a sustainable solution and so would be proposed. Where the VFM ratio is below 1.0, this is an indication of poor value for money and would probably not be proposed, although professional judgement should also be applied in the decision as to whether or not a noise barrier should be proposed.

4.2.2. The valuation of costs has used a whole-life cost approach which has considered a 60-year appraisal period after proposed scheme opening. The costs do not account for traffic management as it is assumed traffic management would be provided initially by the SM project for the initial installation, and then would be provided for other major maintenance activities in the future (e.g. carriageway resurfacing) during which time the noise barrier could be renewed.

4.2.3. In line with the guidance from the Department for Transport in WebTAG, the impacts of the proposed scheme have been based on the difference (noise barrier insertion loss) in both the opening year (2021) and the design year (2036) comparing the DS without mitigation and the DS with mitigation scenarios.

4.2.4. The results of the cost benefit analysis undertaken for the barriers therefore have the potential to change as a result of retaining the concrete surface between Junctions 5 and 7. In basic terms, the noise level at a given NSR is likely to increase as a result of the proposed scheme if the concrete surface is retained, as there will be no new LNRS in place on the motorway carriageway. As the attenuation derived from a noise barrier is predominantly a function of geometry, it would be expected that the attenuation afforded by a noise barrier would not alter based on retaining the concrete surface. Therefore, it would be

expected that, for any given noise barrier between Junctions 5 and 7, the monetised benefits would increase, as the barrier will provide the same level of attenuation but would be acting to mitigate higher noise levels.

4.2.5. For the proposed scheme as a whole, 18 candidate noise barriers were previously assessed as part of the EAR, of which 11 were found to provide value-for-money (i.e. their acoustic benefits, derived from monetising effects on health and quality of life, outweighed the costs of installing and maintaining the barrier) and therefore, were recommended as proposed noise barriers to be taken forward. Only one of these 11 barriers (NNB17) was required for mitigation and this does not lie between Junctions 5 and 7.

4.2.6. Of the 18 candidate barriers, three are located between Junctions 5 and 7. Of these three barriers, only two (NNB2 and NNB4) were found to provide value-for-money in the EAR.

4.2.7. All three barriers between Junctions 5 and 7 have been re-evaluated to determine whether they now represent value-for-money with the concrete surface retained, and if so, whether a different height would now be more appropriate. Table 4.3 presents a summary the change in the value-for-money analysis of these three barriers.

Table 4.3 : Value for money assessment of candidate noise barriers between Junctions 5 and 7

Barrier Reference	Height	Value for money ratio presented in EAR	Value for money ratio, with concrete surface retained
NNB2 – 4m high barrier taken forward	2m	0.5	0.7
	3m	1.1	1.7
	4m (taken forward)	1.3	1.9
NNB3 – not taken forward as not value-for-money	2m	0.1	0.3
	3m	0.3	0.5
	4m	0.4	0.8
NNB4 – 3m high barrier taken forward	2m	3.6	5.2
	3m (taken forward)	5.2	7.3
	4m	4.5	6.3

4.2.8. The analysis has demonstrated that the two proposed noise barriers (NNB2 and NNB4) still provide value-for-money and that there should be no change to the height of the proposed barriers as presented in the EAR.

4.2.9. Further analysis has been undertaken on each noise barrier that was considered in the EAR, and is presented in Table 4.4 below.

Table 4.4 : Qualitative analysis of cost benefit analysis of noise barriers with concrete surface retained

Barrier Reference	Height	Value for money ratio with concrete surfacing retained	Comment	Recommendation as a result of retaining the concrete surface
NNB1	3m	2.0	The 3m barrier would still provide value for money with the concrete surface between Junctions 5 and 7 retained.	Barrier proposed
NNB2	4m	1.9*	Reanalysis shows increase in VFM as a result of retaining the concrete surface.	Barrier proposed
NNB3	4m	0.8*	Reanalysis shows increase in VFM as a result of retaining the concrete surface but ratio still below 1. There is an existing c. 6m high bund in this area; therefore, even a 4m high barrier does not provide any additional benefit.	No barrier proposed
NNB4	3m	7.3*	Reanalysis shows increase in VFM as a result of retaining the concrete surface.	Barrier proposed
NNB5	3m	0.8	Discounted as the acoustic VFM is less than 1. The M27 is in cutting at this location therefore the barrier is not providing much additional benefit.	No barrier proposed
NNB6	4m	0.7	Discounted as the acoustic VFM is less than 1. The M27 is in cutting at this location therefore the barrier is not providing much additional benefit.	No barrier proposed
NNB7	3m	0.6	Discounted as the acoustic VFM is less than 1 and very few dwellings lie in close proximity to the candidate barrier.	No barrier proposed
NNB8	4m	0.9	Discounted as the acoustic VFM is less than 1 and very few dwellings lie in close proximity to the candidate barrier.	No barrier proposed
NNB9	3m	1.8	The 3m barrier would still provide value for money with the concrete surface between Junctions 5 and 7 retained.	Barrier proposed
NNB10	3m	0.7	Discounted as the acoustic VFM is less than 1. The M27 is already in cutting in this area therefore the barrier is not providing much additional benefit.	No barrier proposed
NNB11 and 12	3m	1.2	The 3m barrier would still provide value for money with the concrete surface between Junctions 5 and 7 retained.	Barrier proposed
NNB13	3m	2.4	The 3m barrier would still provide value for money with the concrete surface between Junctions 5 and 7 retained.	Barrier proposed
NNB14	4m	1.8	The 3m barrier would still provide value for money with the concrete surface between Junctions 5 and 7 retained.	Barrier proposed

NNB15	3m	5.5	The 3m barrier would still provide value for money with the concrete surface between Junctions 5 and 7 retained.	Barrier proposed
NNB16	3m	6.3	The 3m barrier would still provide value for money with the concrete surface between Junctions 5 and 7 retained.	Barrier proposed
NNB17 (mitigation)	4m	1.4	The 3m barrier would still provide value for money with the concrete surface between Junctions 5 and 7 retained. This barrier is required for mitigation.	Barrier proposed
*This denotes that the value for money (VFM) ratio has been reanalysed since that presented in the EAR as a result of retaining the concrete surface between Junctions 5 and 7.				

4.2.10. From Table 4.4, it can be concluded that there would be no changes in the recommendations of the EAR as a result of retaining the concrete surface between Junctions 5 and 7. Therefore the mitigation/enhancement measures proposed in the EAR remain valid.

4.3. Noise policy statement for England assessment

Introduction

4.3.1. The current national noise policy in England is based on the NPSE, which through the effective management and control of environmental noise within the context of Government policy on sustainable development, aims to:

1. "*Avoid significant adverse impacts on health and quality of life.*
2. *Mitigate and minimise other adverse impacts on health and quality of life.*
3. *Contribute to improvements to health and quality of life, where possible."*

4.3.2. Table 4.5 shows the values adopted for the day-time and night-time SOAEL[4] and LOAEL[5], which have been used to demonstrate compliance with the NPSE.

Table 4.5 - SOAEL and LOAEL thresholds for road traffic noise during the day and night-time

Parameter	Value for day-time	Value for night-time
SOAEL	68 dB $L_{A10,18h}$ (façade) 63 dB $L_{Aeq,16h}$ (free-field)	55 dB $L_{night,outside}$ (free-field)
LOAEL	55 dB $L_{A10,18h}$ (façade) 50 dB $L_{Aeq,16h}$ (free-field)	40 dB $L_{night,outside}$ (free-field)

4.3.3. Further to the above, the Government's Planning Practice Guidance (PPG) on Noise states that "*in cases where existing noise sensitive locations already*

[4] The SOAEL is the significant observed adverse effect level, and is the level above which significant adverse effects on health and quality of life occur.
[5] The LOAEL is the lowest observed adverse effect level, and is the level above which adverse effects on health and quality of life can be detected.

experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur".

Assessment

4.3.4. The proposed scheme, with the concrete surface retained between Junctions 5 and 7, would not give rise to any significant adverse effects with the inclusion of noise barrier 17 (NNB17) as stated in paragraphs 4.1.5 and 4.1.10. Therefore, the first policy aim is met, as significant adverse effects have been avoided.

4.3.5. With regards to the second and third policy aims, the 11 noise barriers that have been found to be value-for-money minimise noise levels at sensitive receptors in their vicinity. Furthermore, the LNRS to be laid between Junctions 4 and 5 and between Junctions 7 and 11 on lanes 1 and 4 in the opening year and all four lanes in the design year, will minimise noise levels at sensitive receptors along the scheme in these areas.

4.3.6. Table 4.6 and Table 4.7 present the population (assuming an average of 2.3 people per household[6]) above and below the operational SOAEL and LOAEL in the short-term and the long-term respectively, with the concrete surface between Junctions 5 and 7 retained.

Table 4.6 : Short-term NPSE summary

Noise level	Day-time (population)			Night-time (population)		
	DM 2021	DS 2021	Difference	DM 2021	DS 2021	Difference
Above SOAEL	4,869	4,524	-345	11,495	10,617	-879
Between LOAEL and SOAEL	24,194	23,867	-327	22,825	23,704	879
Below LOAEL	5,258	5,929	672	0	0	0

4.3.7. In the short-term, within the population in the Calculation Area as a whole, 345 fewer people would be subject to a level above the daytime SOAEL and 327 fewer people would be subject to noise levels that lie between the LOAEL and the SOAEL as a result of the proposed scheme, with the existing concrete surface retained between Junctions 5 and 7.

[6] The 2011 Census reports that, nationally, the average household size is 2.3 people per household.

Table 4.7 : Long-term NPSE summary

Noise level	Day-time (population)			Night-time (population)		
	DM 2021	DS 2036	Difference	DM 2021	DS 2036	Difference
Above SOAEL	4,869	5,145	276	11,495	11,661	166
Between LOAEL and SOAEL	24,193	23,715	-478	22,824	22,660	-166
Below LOAEL	5,258	5,460	202	0	0	0
Noise level	**DM 2021**	**Ds 2036**	**Difference**	**DM 2021**	**DS 2036**	**Difference**
Above SOAEL	4,869	4,975	106	11,495	11,208	-288
Between LOAEL and SOAEL	24,193	23,881	-313	22,824	23,113	288
Below LOAEL	5,258	5,465	207	0	0	0

4.3.8. In the long-term, within the population in the Calculation Area as a whole, 276 more people would be subject to a level above the daytime SOAEL if the proposed scheme did not go ahead. This is due to natural growth and additional traffic associated with committed developments between 2021 and 2036. The proposed scheme with the existing concrete surface retained between Junctions 5 and 7 would result in 170 fewer people subject to a level above the daytime SOAEL within the population as a whole during the day-time in 2036.

4.3.9. Whilst there are properties that are still exposed to noise levels above the LOAEL and SOAEL, the proposed scheme with the existing concrete surface retained between Junctions 5 and 7, as a whole, results in a reduction in the overall number of people that are exposed to noise levels above the SOAEL and between the LOAEL and SOAEL, both in the short-term and the long-term.

4.3.10. Further to the above, no properties that are already exposed to the SOAEL in the DM 2021 scenario are predicted to experience a 1 dB increase in noise in the long-term (i.e. between DM 2021 and DS 2036). Consequently, the proposed scheme is considered compliant with the aim of the PPG to protect existing noise sensitive locations which already experience high noise levels from small increases in noise levels.

4.3.11. Therefore, with the retention of the concrete surface between Junctions 5 and 7, it is considered that the second and third aims of the NPSE are also achieved.

5. Summary and conclusions

5.1.1. This Technical Note has been prepared to present the findings of the reassessment of noise impacts resulting from the retention of the concrete surface between Junctions 5 and 7 on the M27 SM scheme, rather than resurfacing all four lanes with a new LNRS as assumed in the EAR. All other design assumptions within the EAR remain valid, including construction phase assumptions, and there is therefore no effect on the assessment presented within the EAR due to any changes to other design assumptions.

5.1.2. Analysis has been undertaken to determine whether the change from four lanes of new LNRS between Junctions 5 and 7 to retaining the concrete surface would:

- Result in any significant adverse impacts at noise sensitive receptors (NSRs);
- Result in additional noise mitigation being required for the proposed scheme to mitigate significant adverse effects;
- Affect the results and outcomes of the cost benefit analysis of the noise barriers as presented in the EAR, thus resulting in additional/reduced noise mitigation and enhancement measures;
- Still result in the proposed scheme meeting the aims of the Noise Policy Statement for England and the Planning Practice Guidance;
- Affect the conclusions of the EAR.

5.1.3. The analysis undertaken has shown that no NSRs would experience significant adverse noise effects as a result of the proposed scheme with the concrete surface retained in the short and long-term; therefore no additional mitigation measures are required. This assumes that the mitigation and enhancement measures (11 proposed noise barriers) as presented in the EAR are constructed.

5.1.4. Notwithstanding the above, it should be noted that the proposed scheme would overall be less beneficial as a result of retaining the concrete surface, as shown by the reduction in the number of NSRs experiencing a perceptible (minor to major) noise decrease; a reduction of 4,171 in the short-term and 2,046 in the long-term.

5.1.5. To summarise, retaining the concrete surface between Junctions 5 and 7 does not result in any significant adverse noise effects at NSRs; therefore, no additional mitigation measures are required beyond those presented in the EAR.

5.1.6. As part of this reassessment, the cost benefit analysis of the three noise barriers between Junctions 5 and 7 has been revisited. The reanalysis has demonstrated that, out of the three barriers in this area, two noise barriers still provide value-for-money (and slightly higher than that presented in the EAR) and that there should be no change to the height of the previously proposed barriers. The remainder of the noise barriers analysed in the EAR have been assessed qualitatively, and it is considered that the results of the cost benefit analysis of noise barriers carried out for the EAR would not fundamentally change as a result of retaining the concrete surface. Therefore, those barriers included in the EAR still remain as proposed, whilst those excluded remain so.

5.1.7. With regards to achieving the aims of the NPSE, as the proposed scheme with the concrete surface retained does not give rise to any to any significant adverse effects and with the inclusion of noise barrier 17 (NNB17) for mitigation, the first policy aim is met. Furthermore, the proposed scheme with the concrete surface retained results in an overall reduction in the number of people exposed to noise levels above the SOAEL and between the LOAEL and SOAEL, in both the short-term and the long-term. Therefore, with the retention of the concrete surface between Junctions 5 and 7, it is considered that the second and third aims of the NPSE are also achieved.

5.1.8. In conclusion, with the inclusion of noise barrier 17 (NNB17) for mitigation, the proposed scheme, with the concrete surface between Junctions 5 and 7 retained, will not result in any significant adverse effects. Furthermore, with the mitigation and proposed enhancement measures in place, the proposed scheme as a whole will provide an overall benefit, with a reduction in number of people exposed to noise levels above SOAEL and between the LOAEL and SOAEL. Consequently, with the retention of the concrete surface between Junctions 5 and 7, the conclusions of the EAR remain valid.

Appendix A

Appendix A – Pavement figures

Appendix B

Appendix B – Short-term change in noise level

Appendix C

Appendix C – Long-term change in noise level